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THREE IMPORTANT WILD DUCK FOODS.

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The vegetable food of wild ducks includes a large variety of plants, of which three have been found of especial importance. These three are wild rice, wild celery, and pondweeds.

Wild celery beds and wild rice marshes have long been recognized as important features of ducking grounds. Less widely known, but not less important, are the submerged plants known as pondweeds. In the case of 16 of the most important species of game ducks whose stomachs have been examined, wild celery, wild rice, and pondweeds collectively compose 25.31 per cent of the total food. The percentages of these foods consumed by the various species are given in the accompanying table. Too much reliance, however, should not be placed on these percentages, since the number of stomachs of some species is none too great, and examination of a larger number may necessitate material changes in the figures.

Percentages of the food of 16 species of wild ducks provided by wild rice, wild celery, and pondweeds.

Common name.	Scientific name.	Number of stomachs examined.	Per cent of total contents composed of—			
			Wild rice.	Wild celery.	Pondweeds.	Total of the three.
Mallard	*Anas platyrhynchos*	209	17.13	2.48	12.67	32.28
Black duck	*Anas rubripes*	51	12.05	2.37	8.35	22.77
Gadwall	*Chaulelasmus streperus*	37	.....	.....	17.64	17.64
Baldpate	*Mareca americana*	30	7.16	10.00	13.71	30.87
Green-winged teal	*Nettion carolinense*	126	4.56	.69	10.32	15.57
Blue-winged teal	*Querquedula discors*	86	3.46	.20	9.83	13.49
Shoveler	*Spatula clypeata*	49	.....	.....	7.83	7.83
Pintail	*Dafila acuta*	67	4.95	1.80	13.39	20.14
Wood duck	*Aix sponsa*	75	11.62	3.17	6.72	21.51
Redhead	*Marila americana*	60	4.41	11.71	24.38	40.50
Canvasback	*Marila vallisneria*	60	.33	23.71	42.35	66.39
Scaup, or bluebill	*Marila marila*	67	1.26	14.46	23.20	38.92
Lesser scaup, or bluebill	*Marila affinis*	126	7.49	17.53	8.18	33.20
Goldeneye	*Clangula c. americana*	23	.....	2.95	6.56	9.51
Bufflehead	*Charitonetta albeola*	36	2.22	5.66	4.46	12.34
Ruddy duck	*Erismatura jamaicensis*	41	.....	9.54	12.56	22.10
Average		.....	4.78	6.65	13.88	25.31

To many it may appear that the average percentages of wild rice and wild celery eaten by ducks are low, but it must be remembered that these foods are by no means universally distributed, nor are they

accessible at all times of the year. Although on first thought a percentage of less than 5 for wild rice may seem small, it really means that these 16 species of ducks get a twentieth of their annual subsistence from this grain; in other words, the quantity they eat would support them for two and a half weeks if wild rice were fed upon exclusively. Similarly, wild celery, which forms 6.65 per cent of their food, would suffice for three and a half weeks; and pondweeds, which form 13.88 per cent, for more than seven weeks.

The fact that wild celery and wild rice, although naturally of local and restricted distribution, may be grown in suitable places over the whole United States should be more widely known. There is no doubt that by transplanting and sowing the seeds of these and other plants used by ducks for food many depleted ducking grounds can be restored and new grounds can be created. This means much in the effort to preserve our valuable wild ducks. In the present circular it is proposed to give a brief statement of the value of the three plants as duck food, to show by means of description and illustration how each may be recognized, and to explain where and how each may be propagated.

WILD RICE.

VALUE AS DUCK FOOD.

Wild rice (*Zizania palustris* and *Zizania aquatica*)[1] in every stage of its growth is eaten by one or another of the North American ducks and geese, and practically all of them feed on its ripened grain. It is the staple fall food of many ducks in the numerous rice marshes of the eastern part of the United States. Ducks obtain seeds mainly from the bottom in shallow water, where they have fallen into a bed of soft muck to await germination. Germination is often so delayed that grain may sprout at any time up to at least 18 months after ripening. This accounts for the fact that young shoots and germinating seeds of wild rice are found in ducks' stomachs at practically all seasons. The shoots are devoured by many species; the flowers have been found in the wood duck's stomach; and the stems and leaves of the mature plants are eaten by geese. According to present information the mallard appears to eat the largest percentage of wild rice, more than a sixth of its annual food being rice. The black duck and the wood duck rank next as consumers of wild rice, but several other species take noteworthy quantities.

DESCRIPTION OF PLANT.

Wild rice is a tall, round-stemmed grass with long, flat, pointed leaves (fig. 1). The stem is hollow, but is furnished with transverse partitions between as well as at the joints. These partitions may

[1] For a fuller account of wild rice the reader is referred to the following publications of the Bureau of Plant Industry, from which many of the details here given are taken: Wild Rice: Its Uses and Propagation (Bulletin 50, 1903); The Salt Water Limits of Wild Rice (Bulletin 72, Part II, 1905); The Storage and Germination of Wild Rice Seed (Bulletin 90, Part I, 1905).

FIG. 1.—Wild rice in flower. (One-half natural size.)

be seen when the stem is cut lengthwise. The base of the stem is in the form of a stout hook and from it arise the numerous fibrous roots which serve mainly to anchor the plant to the bottom. The flowers of wild rice usually appear during the latter part of July, but may be found as late even as November. The appearance of the flower head is very characteristic (fig. 1); the lower branches, which bear the staminate or male flowers, are widely separated and

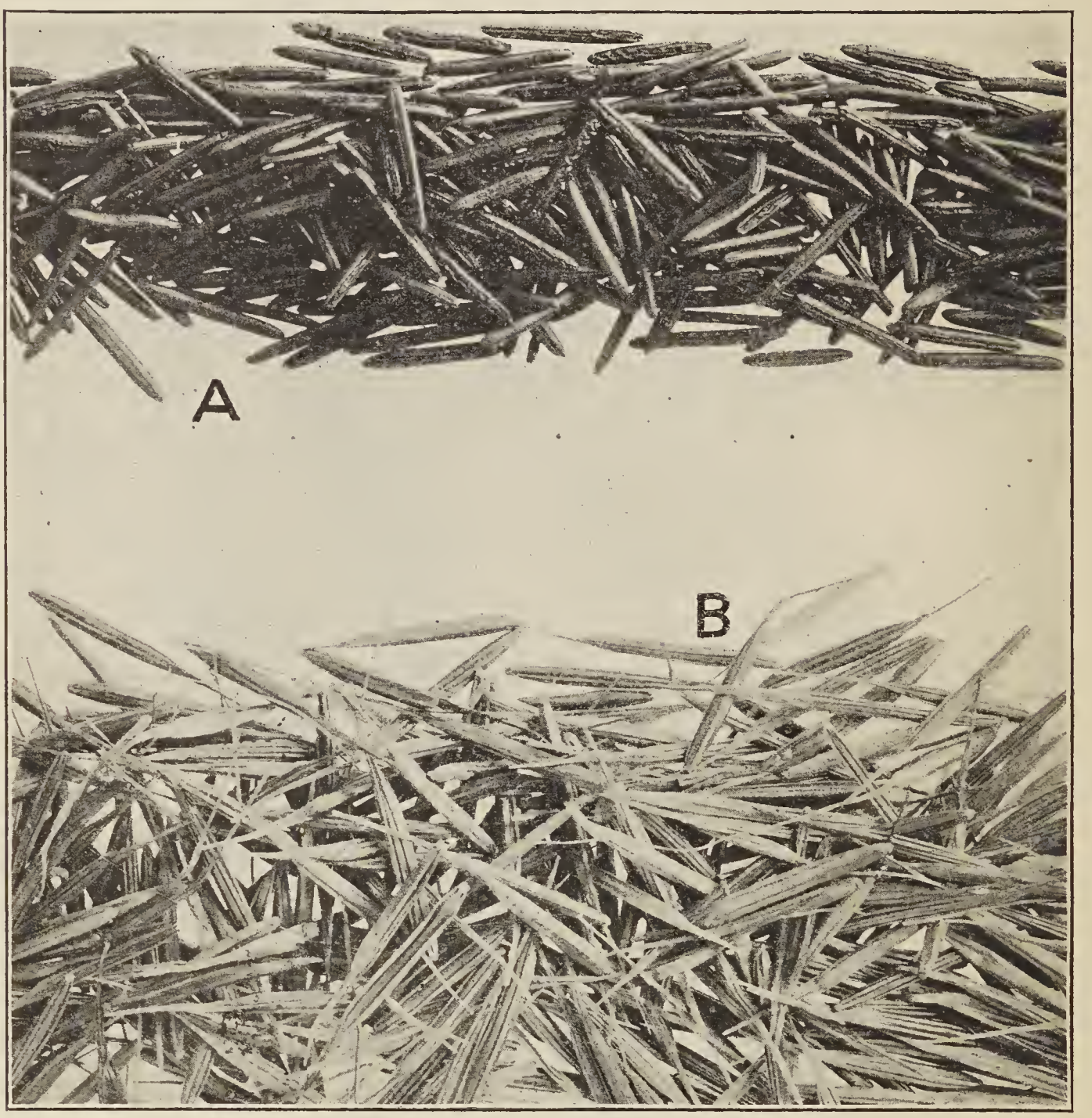

FIG. 2.—Wild rice seed with the hull off (A) and with the hull on (B). (From Bul. 50, Bureau of Plant Industry.)

stand out from the stem, while the upper branches of pistillate flowers are erect and more or less compactly grouped together. The grain (fig. 2, A) of wild rice is from one-half to three-fourths of an inch in length, slender, of uniform diameter, and with rounded or pointed ends. A low rib runs along the whole length of one side and a shallow groove along the other. The husk of the seed (fig. 2, B) has six longitudinal grooves and a long pointed beak, the whole

being an inch and a half or sometimes even more in length. The appearance of the flower head, or of the grain, distinguishes wild rice from any other aquatic grass in its range.[1]

DISTRIBUTION.

Natural growths of wild rice have been found from the northern end of Lake Winnipeg eastward along the northern shores of the Great Lakes and the St. Lawrence River to New Brunswick;[2] from central Dakota, western Nebraska, and eastern Texas to the Atlantic

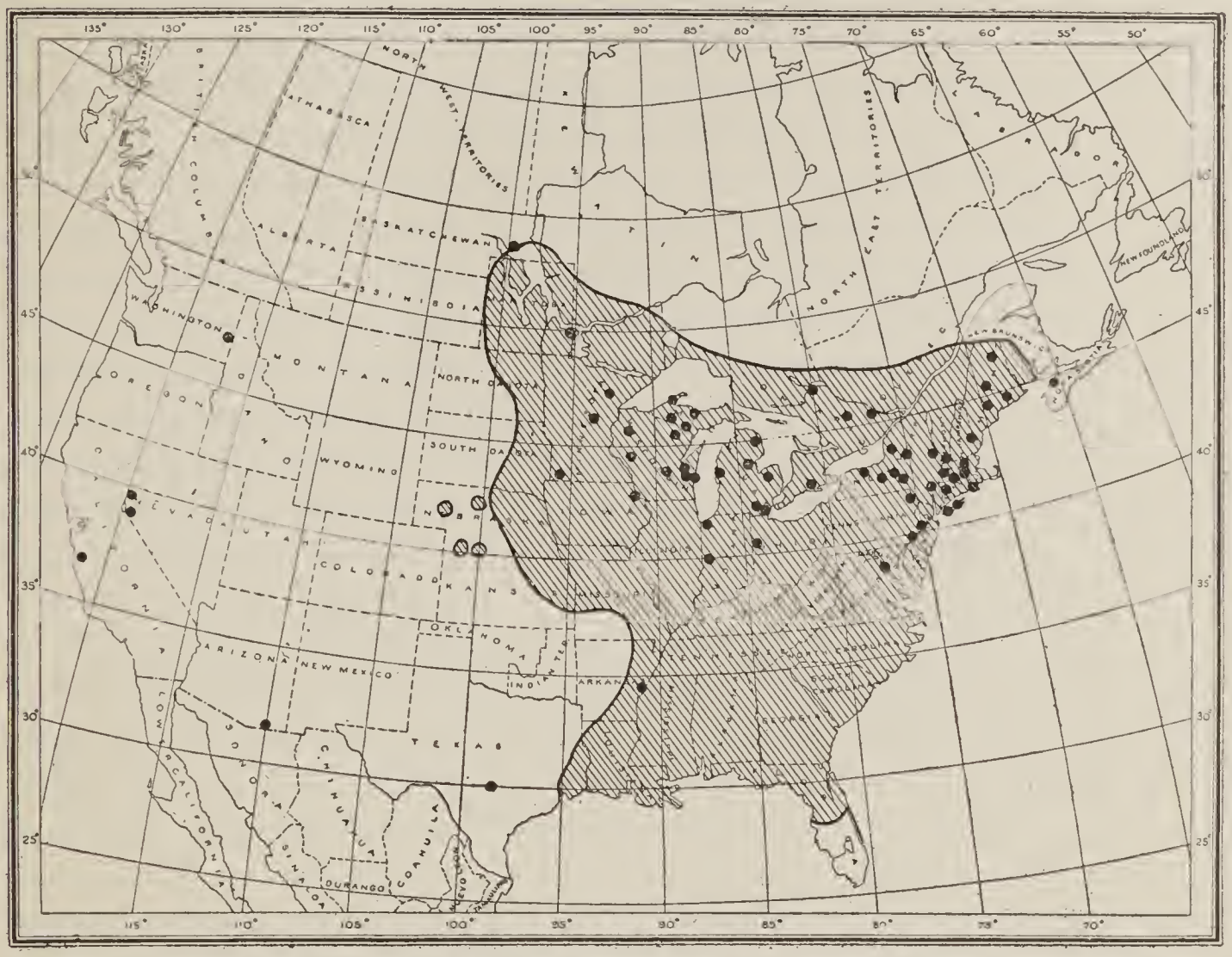

FIG. 3.—Range of wild rice. (Black spots show where it has been successfully transplanted.)

coast; and as far south along that coast as central Florida. (See fig. 3.) The plant is rather local and of course is confined to the lowlands. The center of abundance is in Wisconsin, Iowa, and Minnesota.

TRANSPLANTING WILD RICE.

Although wild rice does not grow naturally in every suitable place within its range, in most cases it can be made to do so by transplanting. Formerly wild rice was often transplanted by various tribes of Indians, and investigations by the Bureau of Plant Industry have shown that with proper treatment of the seed the plant may

[1] The southern Zizaniopsis, with flower and grain superficially much like Zizania, does not have the flower head as a whole divided into pistillate and staminate parts, and the grain is short and without beak.

[2] It is reported without definite locality from Newfoundland.

be propagated in any favorable waters in the country. It has also been successfully grown in Europe. The black spots on the accompanying map (fig. 3) represent numerous localities where it has been successfully transplanted in North America. The showing thus made should encourage those who are looking for a plant to make barren waters attractive to ducks, and especially those who have already tried wild rice without success. However, experimenters must be prepared for occasional failure, for both wild rice and wild celery sometimes refuse to grow in localities which appear to possess every requisite for their successful propagation. The usual cause of failure has been improper treatment of the seed between the time of harvesting and sowing, resulting in loss of vitality. When growing naturally, the ripe seeds fall directly into the water, where they sink, and, being provided with barbed beaks, penetrate deeper and deeper into the muck surrounding the roots of the parent plant. There they lie through the winter. They may germinate in spring, or they may lie practically dormant through still another cold season. The seeds therefore remain wet until ready to sprout; they are exposed to currents of water, are not in close contact with each other, and are not subjected to very high temperatures. To succeed with wild rice it is necessary only to imitate nature's methods. Keeping large quantities of the seed in close contact often causes fermentation, but this can be prevented by cold storage.

So far as propagation depends on the preservation of the vitality of the seed, the methods[1] so carefully worked out by the Bureau of Plant Industry insure success. Several seed firms now handle wild rice properly, and will deliver it in either spring or fall as desired. The grain is kept wet and in cold storage and when shipped is packed in damp moss or fiber.

Sometimes when the stand of wild rice has become reduced, it is advisable to prevent consumption by ducks by harvesting the grain and then sowing it after the spring migration. Because the seeds of wild rice ripen and drop off a few at a time, the seed must be collected every day or so, or the heads must be bunched and tied, so as to prevent the loss of seed. The grain may perhaps be allowed to stand a short time in cold water (if the water is changed daily). But when the whole crop has been gathered, it should be placed at once in cold storage at a temperature just above freezing, or from 32° to 34° F., but still exposed to the air in an open cask or vat.

In cold climates seed may sometimes be perfectly preserved by improvised methods. For instance, wild rice seed kept out of doors and covered with water which was changed daily during the winter except when frozen, germinated very satisfactorily. It has been stored also in partly filled burlap bags among which blocks of ice

[1] Bul. 50, 1903; Bul. 90, Pt. I, 1905.

were placed and the whole covered with sawdust and kept wet. But usually, where cold storage is not available, it is better to buy seed from a reliable firm.

Where to plant.—Wild rice thrives best upon a mud bottom (though it has been known to grow in sand); this may be underlain by various soils, but there should be a layer of mud at least from 2 to 4 inches deep and preferably deeper. Wild rice usually does not do well where there is much current or change in the level of the water, although it grows abundantly on tide flats. It must be remembered that wild rice is not adapted to stagnant water.

It may also be added that the salt-water limits of wild rice may be determined approximately by the simple test of taste. When water is appreciably salty to the taste it is too salty for the successful growth of this plant. [1]

From 4 inches to 6 feet of water are about the limits of its usual occurrence, and it does best in from 1 to 3 feet. In shallow water it may be killed by heat in summer, so it is best, in southern localities especially, to sow the seed in not less than 2 feet of water.

How to plant.—The least possible time must intervene between removal from cold storage and sowing. Broadcast sowing answers every purpose, and the seed should be thickly sown, as the growing plants, when near together, support each other, the root anchorage is protected, and a good stand is more likely to result than if the seed is more widely scattered.

When to plant.—Fall has usually been considered the most desirable time for sowing, but it has been proved that seed sown in spring will bring a full crop, and for several reasons spring sowing is usually advisable. Where seed has been sown in fall, the bottom may freeze and the seed be carried off by the ice in spring. Ducks and other waterfowl, as well as some fishes, eat the seed, and the less it is exposed to their depredations the more abundant will be the crop. Seed is likely also to be buried by depositions of mud, or swept away by currents, especially in freshets. These dangers may be avoided by sowing the seed in spring late enough to avoid the worst spring freshets but in time to get the benefit of the first good growing weather; that is, when the temperature of the water approaches 60° F.

WILD CELERY.

VALUE AS DUCK FOOD.

The names wild celery (*Vallisneria spiralis*) and canvasback duck have been closely associated in the annals of American sport. To a certain extent this association is justified, since the canvasback obtains about one-fourth of its food from this plant—a greater proportion than any other duck. However, the assertion that the flavor

[1] Scofield, C. S., Bul. 72, Bureau of Plant Industry, Part II, p. 8 1905.

of the canvasback is superior to that of any other duck and that it depends on a diet of wild celery is not proved, to say the least. The scaups or bluebills and the redhead also are very fond of wild celery, and are fully as capable of getting the delicious buds as the canvasback. Several other ducks get more or less of this food, the writer finding that even the scoters on a Wisconsin lake in fall lived almost exclusively on it for the time. All parts of the plant are eaten by ducks, but the tender winter buds (fig. 6) and rootstocks are relished best. Wild celery buds can usually be obtained only by the diving ducks, such as the bluebills, redhead, canvasback, and scoters. The nondiving species, as the mallard, black duck, baldpate, and the geese, get an occasional bud, but more often they feed upon the leaves.

FIG. 4.—Wild celery. (Reduced from Reichenbach.)

DESCRIPTION OF PLANT.

Wild celery (fig. 4) is a wholly submerged plant with long, flexible, ribbonlike leaves of light translucent green and of practically the same width (anywhere from one-fourth to three-fourths of an inch) from root to tip. Of course the leaves are narrowed near the tip and may be somewhat serrate or wavy margined there. But they are never expanded and the venation is peculiar. A leaf held up to the light displays numerous straight parallel fine veins running its whole length. There are, besides, one median and two lateral prominent veins connected at intervals by irregular cross veinlets. (See fig. 7.) Wild celery may be distinguished from eelgrass (*Zostera marina*), which lives in brackish or salt water, by the fact that its leaves grow in bundles from the rootstocks, while those of eelgrass arise singly and alternate on opposite sides of the stem. Pipewort (*Eriocaulon*), a fresh-water plant, often having ribbonlike leaves, may be recognized

by the reticulation of the entire leaf into small cells by veins of nearly uniform size.

In certain stages some of the arrowheads (*Sagittaria*) are difficult to tell from wild celery, though they usually have the end of the leaf expanded into a proper leaf blade or else quite pointed, neither of which characteristics is to be found in *Vallisneria*.

The flowers of wild celery, usually seen in July, are peculiar. The staminate flowers attached at the base of the plants shed pollen, which floats on the surface of the water and fertilizes the pistillate flower. The latter is attached to a long, slender, round stem, which

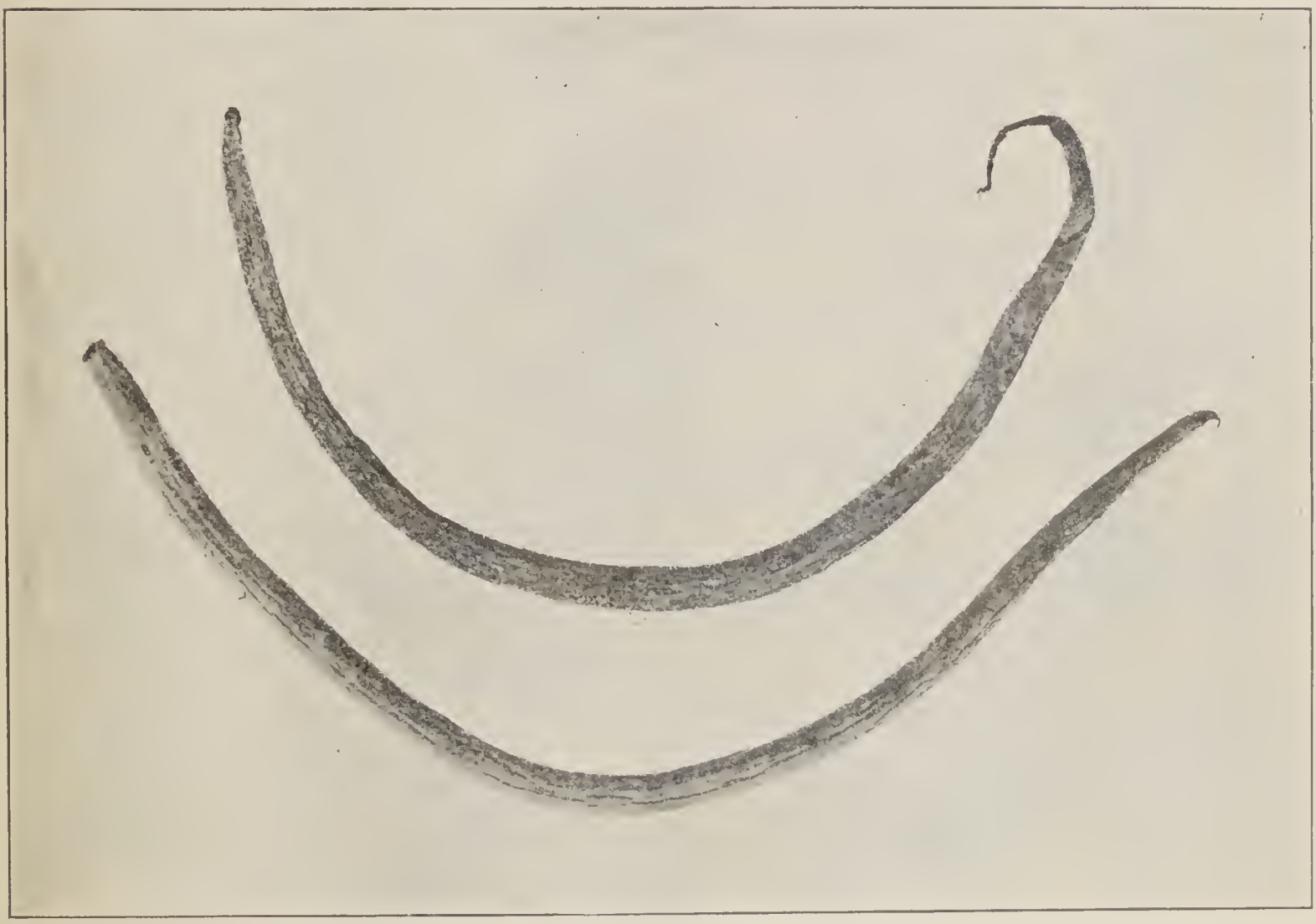

FIG. 5.—Seed pods of wild celery. (Natural size.)

contracts into a spiral, drawing the flower under the water after fertilization. This spiral stem, bearing the flower or pod (fig. 4), distinguishes wild celery from the plants mentioned above. The seed pod into which the pollenized flower develops is straight or curved, a little slenderer than a common lead pencil, and from 3 to 6 inches long (fig. 5). It contains, embedded in a clear jelly, small dark seeds, in number about 50 to the inch. No such pod is borne by any other fresh-water plant.

DISTRIBUTION.

Wild celery occurs naturally from central Minnesota through the Great Lake region to northern Nova Scotia, and from eastern Kansas

and eastern Texas east to the Atlantic coast (fig. 8). Like wild rice it is of more or less local distribution, and consequently may be absent from considerable areas within its general range.

TRANSPLANTING WILD CELERY.

While wild celery has not been transplanted so frequently as wild rice, yet it has been propagated often and in widely separated regions. (See fig. 8.) It is no harder to transplant than wild rice and under proper conditions will undoubtedly grow anywhere in the United States.

Moreover, it can be propagated both by seeds and by winter buds, and the plant itself may be taken up and set out at almost any time. Floating fragments of the plant with a little of the rootstock attached

FIG. 6.—Propagating buds of wild celery. (Natural size.)

have been picked up in midsummer by the writer, and they have rooted and grown successfully. The prime requisites in propagating celery are the same as in the case of rice; the buds, plants, or seeds must not be allowed to dry or to ferment between gathering and planting. The seed pods (fig. 5) ripen from September to November and fall to the bottom. They are best collected (by net or rake) on days when the water is least ruffled during the latter half of October and early November. The winter buds (fig. 6) may be collected at the same season, before the leaves have disappeared, by following the latter down and digging up the rootstocks and buds. Or the young plants just as they sprout in the spring may be taken up. Keep them moist and cool until wanted for planting, as directed for wild rice. If they must be kept for some time, put them in open vessels of water in cold storage.

Where to plant.—Wild celery grows best on muddy bottoms in from 3½ to 6½ feet of fresh water, though it will grow also in sand and in both deeper and shallower water. A sluggish current suits it better than either stagnant or rapid water.

How to plant.—For sowing, the pods should be broken up (in water) into pieces about half an inch in length, which may be sown broadcast—not too thickly, as the plant spreads rapidly by rootstocks and will soon make a dense growth. The winter buds or pieces of roots with tufts of leaves must be weighted to hold them to the bottom and enable them to take root. This may be accomplished by loosely threading several plants together and tying stones to them, or by embedding them in balls of clay. The broken seed pods also may be put into clay and dropped.

FIG. 7.—Leaves of wild celery, showing venation. (Natural size.)

When to plant.—Where they are not likely to be covered by mud, the best time to sow the seed pods is in the fall. Winter buds collected in the fall should be kept in cold storage, and these, as well as young plants gathered in the spring, should be set out in May or June.

PONDWEEDS.

VALUE AS DUCK FOOD.

Referring to the tabulation of duck food on page 1, it will be seen that pondweeds (*Potamogeton*) compose a greater percentage of the food of the 16 species there mentioned than wild rice and wild celery together. This is owing to the wider distribution of pondweeds, allowing ducks to feed on them in winter as well as during migration and in the breeding season. There are no fewer than 38 species of pondweeds in the United States, of which at least 9 (figs. 9–17) are of practically universal distribution. One of the latter number, the fennel-leaved or sago pondweed (*P. pectinatus*, fig. 17), produces numerous tubers (fig. 18) upon the rootstocks, which are eagerly sought by certain ducks.

This one species makes up five-eighths of the whole amount of pondweeds eaten by the canvasback and more than a fourth of the entire food of the bird. Thus it constitutes a slightly greater proportion

of the subsistence of the bird than wild celery. The importance of this plant was pointed out several years ago by Mr. H. L. Skavlem, of Janesville, Wis., who found that at Lake Koshkonong its tubers formed from 60 to 80 per cent of the canvasback's food.

Besides the tubers on the roots, some pondweeds have winter buds among the leaves, and these, as well as the seeds, rootstocks, and indeed the whole plant, are eaten by ducks. As many as 350 tubers and no fewer than 560 seeds have been found in single stomachs. Pondweeds are really staple food for ducks, and nothing is more common in the stomachs than the seeds of these plants.

As mentioned above, there are many species of pondweeds, and they present quite a diversity of forms. Illustrations (figs. 9–17) of the 9

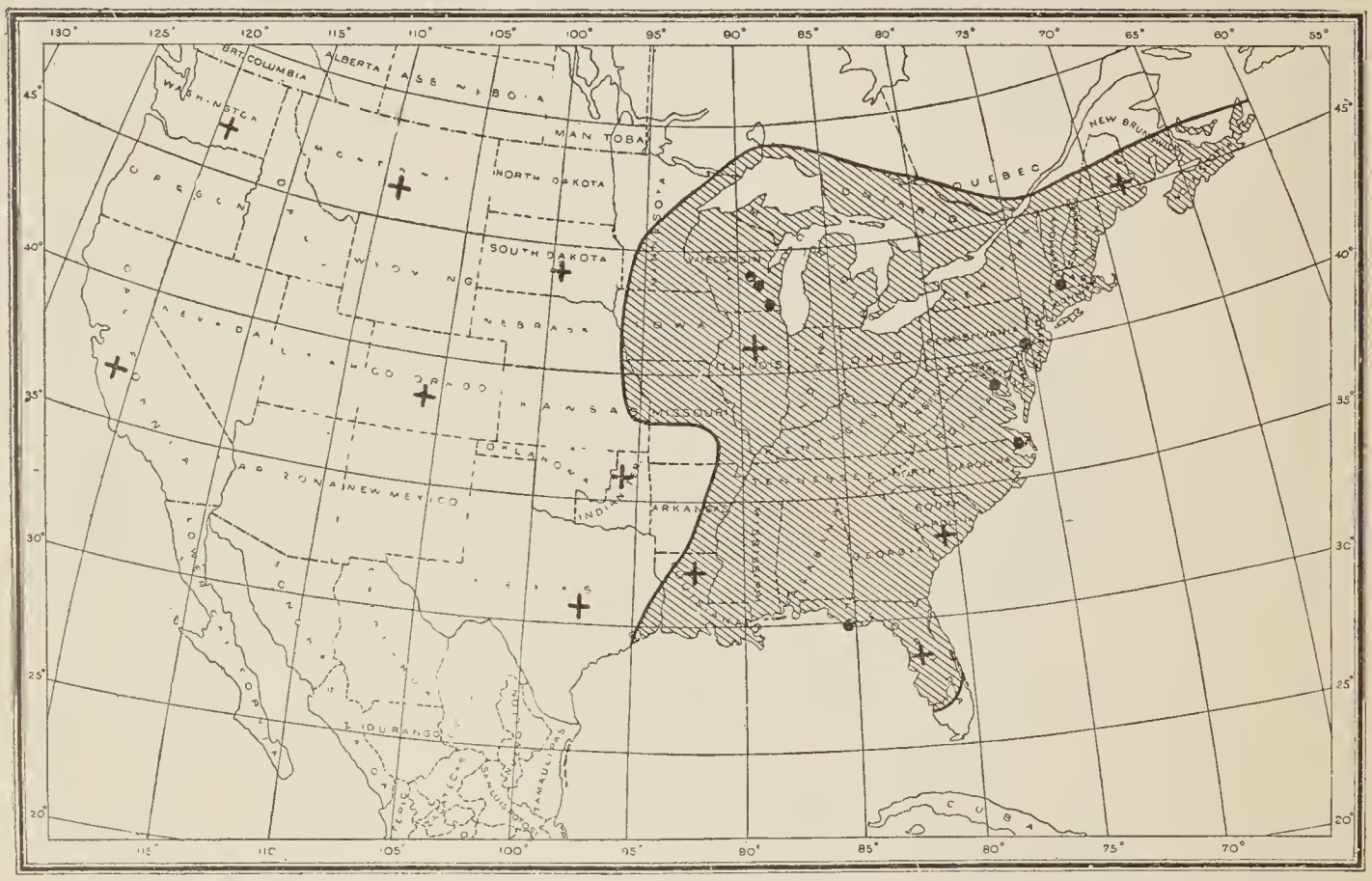

FIG. 8.—Range of wild celery. (Black spots show where it has been successfully transplanted. Crosses indicate States in which it has been propagated, the exact localities being unknown.)

species of general distribution serve to show the general appearance of some of these plants. All Potamogetons are eaten by ducks, and any one of them would be a valuable acquisition for a ducking ground.

The pondweed illustrated by figure 14 (*Potamogeton perfoliatus*) is known as redhead or duck grass, and is an important duck food, said to be especially attractive to redheads. We have found more of it in the stomachs of canvasbacks than of any other species. All told, 10 species of Potamogeton have been identified from duck stomachs, including all but one of the 9 most widely ranging forms. (Figs. 9–17.)

DESCRIPTION OF PONDWEEDS.

The most important species, so far as known, is the sago pondweed (*P. pectinatus*). This plant has numerous rather long threadlike

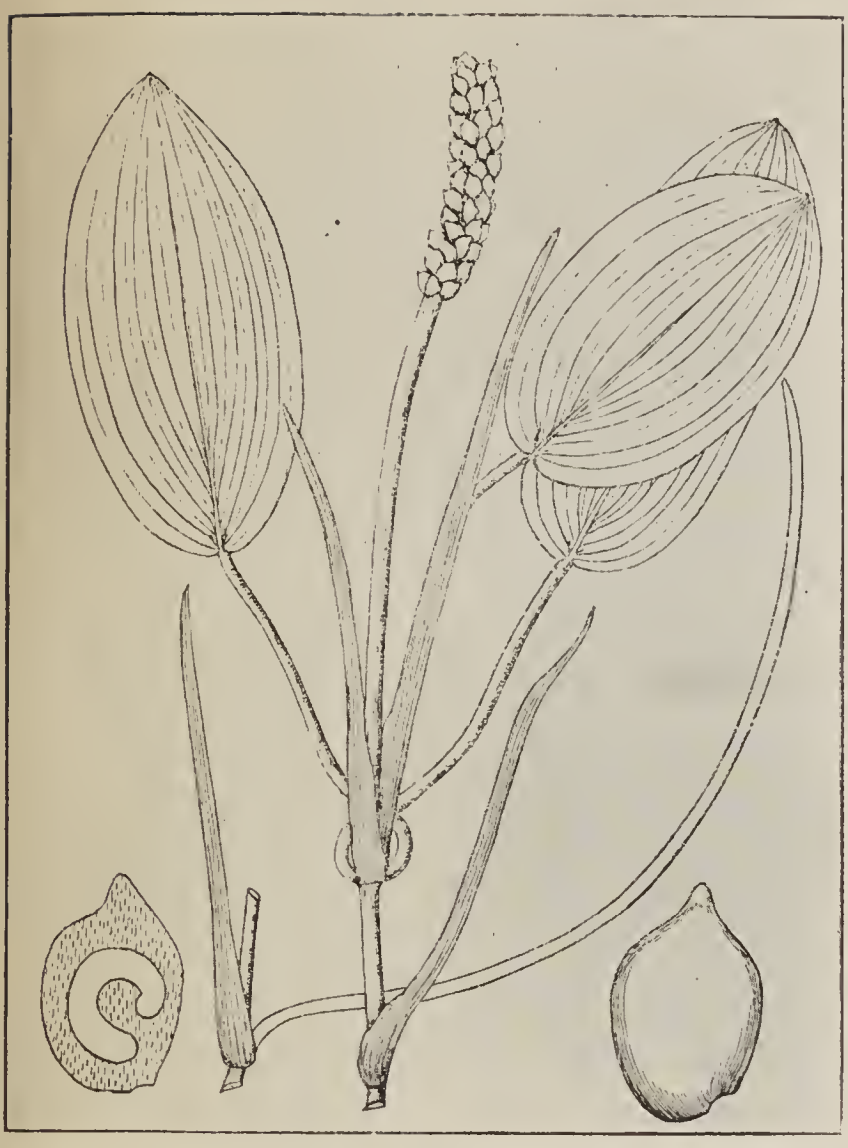

FIG. 9.—Potamogeton natans L.

FIG. 11.—Potamogeton lucens L.

FIG. 11.—Potamogeton heterophyllus Schreb.

FIG. 12.—Potamogeton lonchites Tuckerm.

FIGS. 9–12.—Wide-ranging species of pondweeds. (From Morong.)

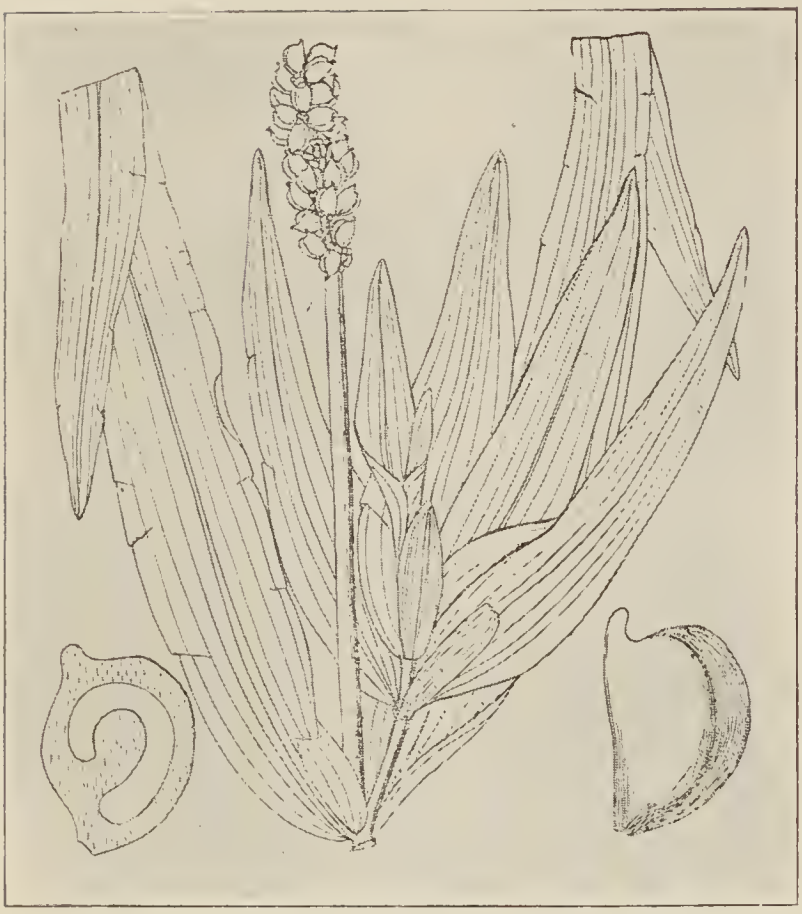

FIG. 13.—Potamogeton praelongus Wulf.

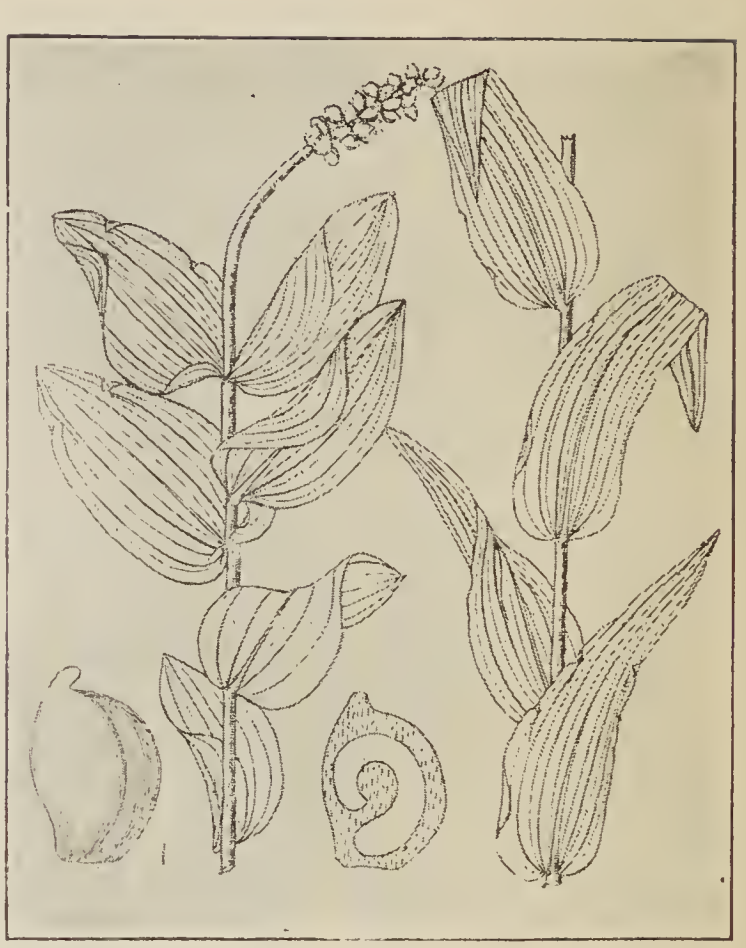

FIG. 14.—Potamogeton perfoliatus L.

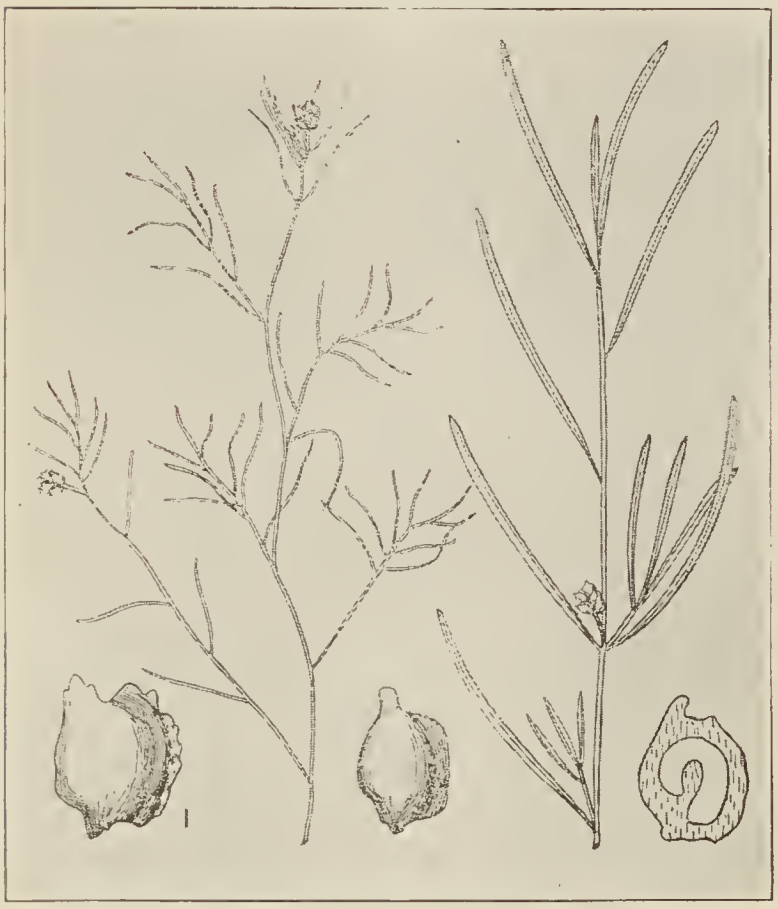

FIG. 15.—Potamogeton foliosus Raf.

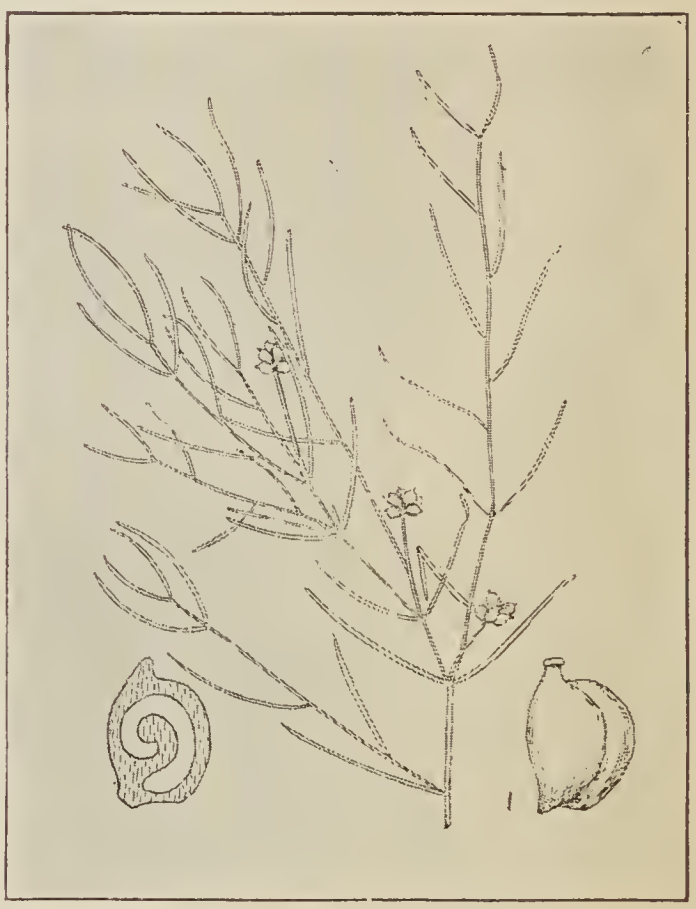

FIG. 16.—Potamogeton pusillus L.

FIGS. 13-16.—Wide-ranging species of pondweeds. (From Morong.)

leaves, which present a loose broomlike appearance in the water. The plant is in some places known as foxtail grass. It is known also as eelgrass, and apparently is the plant termed in Europe poker or pochard grass, after a duck closely related to our redhead. In the autumn, sago pondweed bears small clusters of light brown seeds or nutlets near the surface of the water, in form somewhat like loose bunches of grapes. The other pondweeds bear seeds in the same way, and vast numbers of them are eaten by ducks.

The general appearance of sago pondweed is well shown by figure 17; note the brush of fine threadlike leaves and the seed clusters as above described. Here also are shown the tender rootstocks with their tubers, delicacies much sought by many ducks. Figure 18 illustrates the tubers enlarged.

FIG. 17.—Sago pondweed. (Reduced. From Sunset Magazine, February, 1905.)

DISTRIBUTION.

The range of the sago pondweed is from coast to coast, and as far south as Florida,[1] Texas, the Mexican Plateau, and Lower California, and north to Nova Scotia, Hudson Bay, and along the Pacific coast up to latitude 62° north (fig. 19).

TRANSPLANTING PONDWEEDS.

Much less is known about the transplanting of pondweeds than of wild rice and wild celery, but it is just as feasible. The Fish Commission stations use pondweeds to some extent in their fish ponds, and no difficulty seems to be encountered in transplanting them. Mr. Dwight Lydell, of the Michigan State fish hatchery, states that he has succeeded in propagating Potamogetons by means of seeds and of whole plants. He further states that the most successful and largest growths have been on bottoms where the mud is about 6 inches deep over sand or clay. By mowing the plants in lakes where they are plentiful and scattering them about the ponds, no trouble has been experienced in getting a good crop of

[1] The manuals of botany give the range of this plant as south to Florida. We have been able to find definite records only as far as North Carolina. In our map (fig. 19) the northern limit of the plant is extended to Great Slave Lake, on the basis of the probable distribution of an aquatic plant recorded from the Lewes River at 62° north latitude, and near the mouth of the Severn River, Hudson Bay.

Potamogetons. The writer is indebted to Mr. J. B. White, of Waterlily, N. C., for the information that he has often transplated the sago pondweed about Waterlily. Great success was had with some planted on St. Vincent Island, Fla. It has been propagated also at Janesville, Wis. Redhead grass (*P. perfoliatus*) also has been successfully propagated at St. Vincent Island, Fla.

Those desiring to transplant pondweeds must usually go out themselves to gather them, for the usefulness of the plants has not been sufficiently well known to create a trade in them. The seeds of the various species ripen at different times, but in the north may be looked for after August. Those of sago pondweed are in best condition in

FIG. 18.—Tubers of sago pondweed. (Natural size.)

September and October. After gathering they should be planted at once, or, if held, kept wet and in cold storage.

How to plant.—Pondweeds may be transplanted on a large scale, as noted above, by mowing [1] the whole plants with the seeds attached and scattering about where growth is desired. The seeds alone may be collected and sown broadcast, or they may be embedded in clay balls and distributed over the bottom.

Where to plant.—Most pondweeds require fresh water, but a few species, including the sago pondweed, will grow in brackish or salt water. Mud bottom is preferable, but both sago pondweed and redhead grass will grow on sand. The water in which pondweeds are planted should be from 2 to 6 feet deep.

[1] A description of the machine for mowing aquatic plants may be found in the Report of the U. S. Fish Comm., 1892, pp. 477–478.

When to plant.—The seed may be planted in fall immediately after gathering, or if cold storage is available the seed may be held until spring, as described in the case of wild rice.

FIG. 19.—Range of sago pondweed. (Black spots show where it has been successfully transplanted.)

ENEMIES OF WILD RICE, WILD CELERY, AND PONDWEEDS.

The three genera of plants discussed in this circular vary greatly in abundance, from the most luxuriant growth to entire absence. The causes of this diversity are not well understood, but the plants

have enemies whose habits are known and whose attacks may to some extent be warded off. Wild rice is generally eaten by moose, deer, and cattle; but where the damage warrants the necessary expenditure, they can be fenced out. Muskrats tear up and eat all of these plants, but, so far as known, not to a serious extent. Carp also feed on them, and—

> the evidence seems to be pretty strong that in general they are very destructive, and are probably in large part at least responsible for the great destruction of wild celery and wild rice that has been noted in many of our inland marshes in the last few years. This, in turn, has deprived certain ducks, especially the canvasback and redhead, of an important food supply, and has undoubtedly influenced their abundance to some extent in the localities in question.[1]

In waters controlled exclusively by one interest carp may be extirpated by partial or complete drainage and by the netting of the fish, together with the construction of wire screens or other barriers across all inlets and outlets. Where this is not practicable, systematic poisoning with fish berries or copper sulphate may succeed, but only at the expense of many forms of life besides the carp, and in the long run it might be more injurious to the duck feed than to the carp. However, these methods are applicable only in small bodies of water; elsewhere effective measures against carp are impracticable.

SUMMARY.

Three genera of plants furnish one-fourth of the total subsistence of the 16 most important game ducks in the United States.

It is fortunate that all three can be propagated in suitable waters anywhere in the United States. The one indispensable requisite to their successful transplanting is proper care of the seeds, roots, or tubers. These must be kept wet and either sown promptly after gathering or kept in wet cold storage at a temperature of from 32° to 34° F. The least possible time should intervene between gathering or removing from cold storage and sowing. For shipping the seeds should be packed in damp moss, sphagnum, coconut fiber, or fine excelsior, placed loosely in burlap bags and crated in well-ventilated boxes.

Wild rice and wild celery are exclusively fresh-water plants, but some pondweeds, including sago pondweed, will grow in salt water. All of the plants thrive best on mud bottoms and in moderate depths of water, wild rice in from 1 to 3 feet and wild celery and pondweeds in from 3 to 6 feet. All do best in a slight current. Swift or stagnant waters are ill suited to them, although both wild celery and pondweeds grow in good-sized ponds where there are no currents except those produced by the wind.

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[1] Cole, Leon J., Appendix Rep. Comm. Fisheries for 1904, p. 592, 1905.

As a general rule, the best time to sow these plants is in the spring, but mowed pondweeds and wild celery pods may be distributed in the fall. Pondweed seeds and wild rice may be sown broadcast as soon as the water reaches a temperature of from 50° to 60° F. Wild celery plants should be set out in May or June.

The Biological Survey will be glad to identify aquatic plants of interest in connection with duck food, and will recommend plants for use under special and peculiar conditions.

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